



Project: The justification and implementation of Computer Aided Design (CAD) software into TTSs apprentice training framework.

Organisation: New Zealand Army
Department: Trade Training School (TTS)
Focus Area: Maintenance Support (MS) Apprenticeship Training
Product: CAD Suite and improved training at TTS

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Executive Summary

Keeping up to date and continuously improving the teaching practices used at TTS is fundamental in ensuring that quality tradesmen are deploying on missions around the world with the NZDF. An opportunity to incorporate CAD into the training doctrine at TTS has arisen, which will see TTS remain the centre of excellence for engineering development within NZ Army.

This report investigates the use of CAD as a training medium for the teaching of apprentices in a Maintenance Support role. It then moves on to determine the most efficient means of the setup of a CAD suite at TTS combined with the integration of this new learning tool into the current training framework.

It was found during the investigation that with the influx of equipment entering the NZ Army, TTS will find it difficult to purchase an effective amount of physical training aids. With the introduction of CAD to TTS, electronic replicas of these training aids will be used on the software saving thousands of dollars and thereby decrease the reliance on physical training tools.

Table 1.0: Critical Success Factors and KRAs

Critical Success Factor	KRA
Provide Effective Training.	<ul style="list-style-type: none"> Gain access to pre-modelled drawings. Robust train-the-trainer package. Best software selection.
Low Administrative Burden	<ul style="list-style-type: none"> User friendly operation and transition. Lessons created easily. Cost effective solution.
Versatility	<ul style="list-style-type: none"> Ability to use over all five MS trade groups. Sufficiently self-reliable.

Justifications for installation of a CAD suite include:

- More efficiently teach large groups of students.
- In accordance with the Chief of Army's intent, continue to foster and support innovative thinking and development.
- Continue to implement and use modern teaching practices.
- Utilise the suite in a secondary role as the student's administration (admin) room.
- Ensure TTS remains the centre of excellence for engineering development within the NZ Army.
- Save costs on training aids which typically cost upwards of \$10,000.

CAD is currently not used within NZ Army as a teaching tool and only specialised branches within the organisation use this software on a daily basis. It is not the intent for apprentices to use the design aspects of the software, but to use the many other tools the programme offers. Some of the tools identified include:

- With the use of pre-modelled military components from the Directorate of Land Engineering (DLE);
 - Conduct cross-sectional analysis,
 - Use exploded views to analyse components in depth,
 - Thermo and airflow analysis,
- Construct electrical circuits,

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- Develop CAD technical drawings, and
- Material analysis on components (finite, stress/strain etc).

Many considerations were taken into account with the setup of the CAD suite. Below are some of the key details about the suite which the report discusses more in depth.

- Location – Armourers’ Building.
- Software selection – Autodesk Inventor.
- Hardware – Sourced free of charge from Simulation Centre upgrade (\$45,000 worth).
- Employment – Nil. Train-the-trainer program established for instructor familiarisation.
- Furniture – Already in location due to the room’s previous use as a classroom.
- Installation – CIS authority. Free of charge.

CAD as a training medium has been discussed for each individual trade group in detail as it was identified early on that all five apprenticeships have their own unique learning outcomes. The report extracts knowledge and ideas from other institutions that have incorporated CAD into their training procedure. These include:

- The benefits of transposing information and data into pictorial views.
- How CAD can improve safety in the workplace.
- How interaction with virtual reality can enhance training and learning outcomes.

There has been some delay in receiving the funding to purchase the software (\$12,000). It is expected the funding will be received 15 Feb 14 in which case Capt Vollebregt will see that the software is installed and an opening ceremony conducted.

Below lists some of the key recommendations following the report:

- A minimum of one lesson from each trade group be incorporated into the training schedule in 2014 to ensure instructors become comfortable with the new software. The training program for 2014 has already been designed and budgeted for so a complete transition would be impractical.
- SI MS is given full responsibility of the room which includes:
 - Access approval for outside agencies,
 - Train-the-trainer lessons for new instructors posted to TTS,
 - Maintaining the room to a high standard,
 - Ensuring the learning outcomes of lessons are delivered to a high standard,
 - The renewal of the licensing fee is paid on time every year, and
 - Pre-modelled drawings are received when new equipment enters the NZ Army.
- In 2019 an assessment of the current software is carried out to see if new, more effective means of teaching students via computer based programming is being used in industry. This will ensure TTS remains modern and up to date in regards to teaching practices.
- Second year WELTEC students are utilised in the semester breaks to run Train-the-trainer courses for instructors who are posted to TTS or need re-familiarisation.

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INTRODUCTION

Trade Training School (TTS) was established in 1996 with the amalgamation of the Logistic Corps into the Royal New Zealand Army Logistic Regiment. TTS trains and equips all Royal New Zealand Army Logistic Regiment (RNZALR) soldiers in the NZ Army with the logistical skills required for operational deployment and garrison duties. TTS is made up of five wings:

- Movements Wing,
- Transport Wing,
- Supply Wing,
- Driver Training Wing, and
- Maintenance Support Wing (MSW)

MSW is the focus of this project. MSW is responsible for the training of five Maintenance Support (MS) apprentice groups, these being;

- Armourer,
- Electronic Technician,
- Maintenance Fitter,
- Vehicle Mechanic, and
- Electrical Fitter.

Each of these trades are split into their own sub-wing within MSW.

Currently within MSW there are 23 instructors which leaves a deficit of 14 vacant instructor para-lines. These have been left void due to retention issues and lack of qualified personnel within the MS fraternity in the NZ Army. The instructors within MSW are a mix of civilian and military personnel.

TTS is continuously seeking to improve teaching methods in order to:

- Convey information to students more effectively,
- Alleviate strain put on instructors due to manning shortages,
- Keep up to date with modern teaching practices, and
- Ensuring TTS remains the center of excellence for engineering development.

Each trade group provides a crucial element for being successful on operations and missions - not only over seas - but within New Zealand's borders as well. In order to dominate the battlespace, a commander must have access to responsive and effective maintenance support so as to ensure a continuous presence in his/her area of operations. It is TTSs responsibility to ensure this trade training meets the level required for modern day warfare.

Aim

The aim of the project is to improve the efficiency of apprenticeship training at Trade Training School (TTS) utilising CAD software as a new means of conveying information to students and assist training.

Objective

The objective of the project is to investigate the feasibility of installing a CAD suite at TTS and using this as a new teaching medium. The project will also provide an opportunity to utilise and apply management principles recently attained throughout the MEM. The Chief Instructor (CI) of TTS has authorised the request for an investigation into the installation of a CAD suite. Upon completion of the investigation the installation process will be conducted.

Justifications for installation of a CAD suite include:

- More efficiently teach large groups of students.
- In accordance with the Chief of Army's intent, continue to foster and support innovative thinking and development.
- Continue to implement and use modern teaching practices.
- Utilise the suite in a secondary role as the student's admin room.
- Ensure TTS remains the centre of excellence for engineering development within the NZ Army.
- Save costs on training aids which typically cost upwards of \$10,000.
- Improve safety by using software prior to physical training aids.

Currently the instructor / student ratio is not favourable for TTS as only 66% of all the training staff roles are occupied. More pressure is put on these individuals because the output for quality apprentices remains unchanged (the amount of apprentices received each year also remains unchanged). TTS is continually researching new, more efficient means of teaching students. The investigation includes:

- The effectiveness of CAD as a new training medium,
- The benefits and constraints bestowed upon the unit,
- Cost analysis,
- Indoctrination into current apprenticeship training framework,
- Employment, and
- Software selection.

Traditional apprentice training is normally conducted one-on-one between the student and an immediate supervisor. At TTS training is conducted in groups, with an instructor formally giving lessons and demonstrating hands-on skills before student's under-go tasks themselves. Due to the shortage of instructors this can be quite difficult to achieve. It is not the anticipation for the students to learn how to design components but to study systems utilising pre-designed models and circuitry (such as an engine or gearbox).

Project Scope

The Stage-Gate Model (reference Appendix A) has been utilised throughout the project. The various stages have been broken down into the following segments;

- Current Training Performance,
- CAD as an Effective Teaching Medium,
- CAD Suite Dynamics,
- Indoctrination of lessons,
- Employment Option Finalised, and
- CAD Suite Installation.

Between each stage, at the 'gate', it was decided whether the project would continue, halt or be revised. This process was chosen for its ability to identify problems and assess progress before the projects conclusion. It ensures that before money is spent, that the relevant justifications have been met. It can also save a lot of time if the project does not pass an early gate.

Reference Appendix B – Project Charter.

CURRENT TRAINING PERFORMANCE – STAGE ONE

Stage One – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none"> Analysis of current training regime for each trade group Cost analysis of the training budget 	<ol style="list-style-type: none"> 1. Attain a clear understanding of current learning outcomes. 2. Understand where current deficiencies reside. What effect does the training staff shortage yield? 3. Identify and understand the current expenditure process in place within MSW.

For the majority of the trade groups it takes approximately four years to complete an apprenticeship in the NZ Army (Electronic Technician takes five). Typically a soldier will follow the steps below in order to become trade qualified:

- 1) Enlist during last year of school,
- 2) Complete 16 weeks Basic Training,
- 3) Attend TTS for 18 months for foundation training prior to a posting to 2nd or 3rd Workshop Company,
- 4) Return to TTS for three months in second year to compete Junior Trade Course,
- 5) Return to TTS for three months in third year to complete Intermediate Trade Course,
- 6) Return to TTS in forth year to complete Senior Trade Course,
- 7) Soldier can now be promoted to Lance Corporal, is trade qualified and can be deployed on operations.

Deficiencies

A survey (Fig 1) conducted on the 01 Nov 13 showed the following deficiencies within the MSW. Instructors throughout the various sub-wings were asked what they believed to be the greatest restrictions on their training.

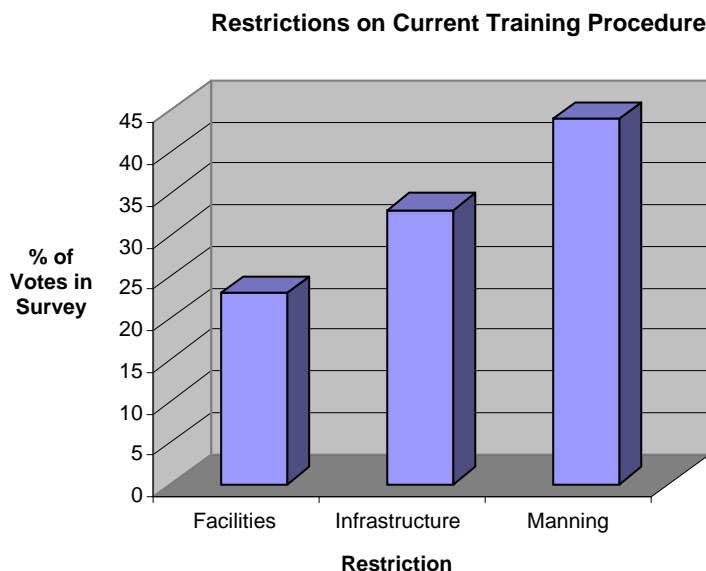


Fig 1

Even with the current instructor shortage, TTS still continues to qualify, quality tradesmen. The units receiving the final 'product' are confident that newly qualified tradesmen are equipped with the skills required for further duty. This project seeks to improve manning and facility restrictions.

Apprentices

Once an apprenticeship commences, the student has signed a return of service obligation – tying him/her to the military for two years post their qualification date. Majority of apprentices remain and eventually qualify however on occasion some do not make the grade and they are removed from trade (normally to another Corps). On occasion TTS will allow a soldier who is struggling in one trade to change to another. This must be endorsed from the Wing Warrant Officer (WWO) of both trades as well as the SI MS and will see the soldiers career put back by 12 months.

92% of students currently within MSW expressed interest in having CAD integrated into their training regime. This is due to many of the students relating to computer software as a learning tool and it will also capitalise on the general computer literacy found in the younger generation.

MSW Structure

Reference Appendix C – MSW Org chart.

Cost Analysis on Current Expenditure

The Senior Instructor MS (SI MS) is responsible for overseeing the budget and all spending within MSW. The WWO for each sub-wing plans the spending for each course run, prior to getting the final approval from the SI MS. A financial report is drafted for the first of every month which makes its way from each wing - to the CI - all the way to the Commandant of Land Operations Training Centre (LOTCT) where it is checked and processed further with NZDF accounts.

Vehicle Mechanic Wing has the largest budget within MSW, consisting of \$110,000 (per annum) with the Electrical Fitters having the smallest - \$45,200. The other sub-wings fit within this budget range.

The budget for this project will be allocated from LOTCTs training account. In order to make a one off purchase that does not fit within your budget, an Item Justification (IJ) must be submitted in order to receive additional funding. The IJ for the CAD Suite was submitted early as many other units will be attempting to receive these funds for their projects. The Commandant will allocate the funding to the unit which has the best justification.

Reference Appendix D – IJ CAD Suite.

CAD AS AN EFFECTIVE TEACHING MEDIUM – STAGE TWO

Stage Two – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none"> Research CAD as a teaching tool for apprentices. Document risks and report to CI. Construct PowerPoint on findings for ENMG608. 	<ol style="list-style-type: none"> Identify how each trade group could utilise CAD as a training tool. Research the different software available. Understand how other training institutions are currently operating. Identify whether other units have drawings available and if so the security implications of using them. Analyse the risks involved for the project.

CAD uses computers and computer software to assist in the creation, modification, analysis, or optimisation of a design. The purpose of this project is to build a CAD suite so students can *analyse* components that are already drawn on the software. The suite can also be used as a general classroom and administration suite for TTS students. There are currently no allocated computers for students to conduct personal administration.

CAD Training within Industry

CAD as a training medium has been studied extensively with the advancement of computer technology in the past decade. Manufacturing plants, which require human assembly processes, are starting to utilise CAD software to familiarise workers with new products that they are required to assemble. Like the manufacturing plants, TTS will have its apprentices putting together assemblies of new equipment entering the NZ Army. Y.X Yao¹ has identified the three functions that are fundamental in developing successful CAD education.

- Visualisation. This function ensures that the operating system the student is using, has the required components and parts required for the lesson to be beneficial. It is important that the computers are modern enough to run the software so the student (in this case an apprentice) can easily manipulate the component. Visualisation is the transformation of data and/or information into a pictorial view.
- Operation. This ensures that the user can not only view the generated computer simulation world, but also interact with it actively. It ensures the student can rotate parts to get a better view and assemble/disassemble at will. Students can also see in what order the parts are put back together rather than taking the time to teach this outcome physically.
- Training. Virtual reality has many benefits in the training environment. Not only does it provide a safe means of teaching staff and students, but it can also be a shortcut in terms of time and cost. The tools that CAD programs use can easily demonstrate the effect external elements (i.e. heat treatment and strain) have on components.

Ertu Unver² conducted a study: Strategies for the Transition to CAD Based Design Education. He argues that it is important not to rely on computer based tutorials without having a tutor to introduce the software first. This highlights the point that TTS will need to ensure instructors are equipped with prior knowledge before undertaking lessons. Unver also stresses that the traditional skills should not become irrelevant and that an education in CAD does not surpass actual hands-on experience. It is not TTSs intent to replace any current training using CAD software but to enhance existing procedure by introducing modern technology.

The following sections will discuss the benefits of CAD for each trade group. Due to the vast differences between the learning outcomes for each apprenticeship, each trade will have to be analysed individually. A discussion with each WWO has occurred and a basic plan has been initiated in order for the best learning outcomes to be exploited using CAD.

Vehicle Mechanic (Veh Mech)

The Veh Mech trade is the largest in terms of students within TTS. The role of a Veh Mech is to repair and maintain all vehicle types within the NZ Army. The Veh Mech role is broken down into two branches:

¹ Y.Z Yao. A Pragmatic System to support interactive assembly planning and training in a virtual environment. Manuf Technol 2006. Pg 1.

² Ertu Unver. University of Huddersfield. Strategies for the Transition to CAD Based 3D design education. 2006, Pg 324.

- **Vehicle Mechanic (Mech)** – aligned with the National Certificate in Automotive Heavy Engineering (Road Transport); and
- **Vehicle Mechanic (Elec)** – aligned with the National Certificate in Automotive Electrical Engineering.

Veh Mech students cover many lessons whilst posted to TTS. The intent is to incorporate CAD software into these lessons so students can use pre-modelled vehicle components and systems to better gain a grasp of the learning outcomes.

Example One: Lesson 5.1.3 - An introduction to Turbo Chargers

The Objective of 5.1.3 is for students to demonstrate knowledge of the operating conditions for a vehicle fitted with a turbo-charged engine.

Currently students are presented with a PowerPoint presentation prior to using training aids. TTS cannot afford training aids for every lesson.

Fig 2

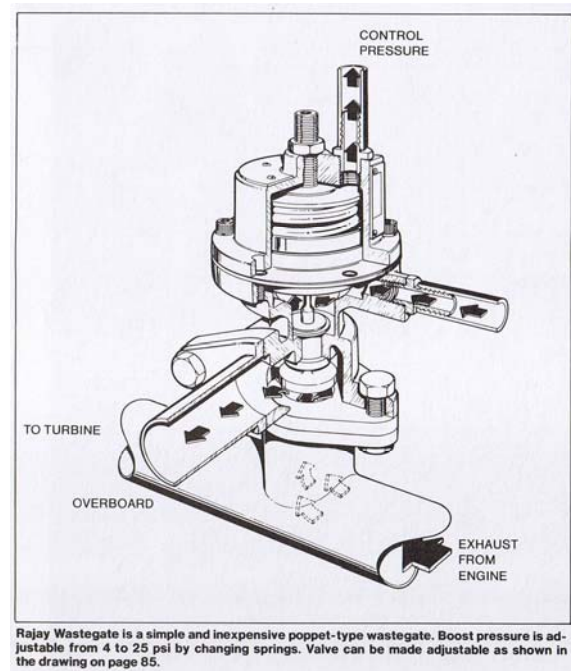
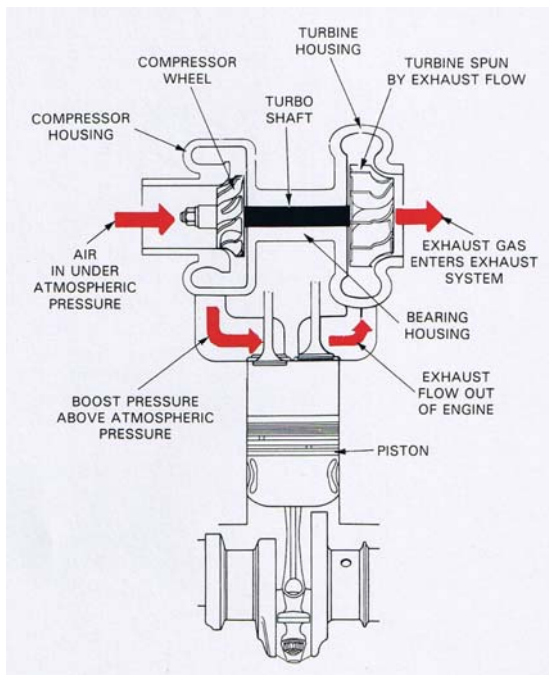


Fig 2 displays two generic diagrams used within the PowerPoint presentation shown to the students (chosen at random).

If these drawings were pre-modelled using existing NZ Army equipment, students can have the benefit of interacting with this equipment using the software throughout the lesson. Interactions would include and are not limited to:

- Using exploded views to see the relation between parts and components as some diagrams fail to illustrate all elements or measurements.
- Have students construct the desired components using pre modelled, unassembled parts. This has the benefit of:
 - Saving time,
 - Sparing resources,
 - All students have their own model,
 - Saving money on training aids, and

- Making the lesson more interactive, safe and interesting.
- Using tools on CAD to identify where stress and strain affects the component as well as demonstrating the effects of applied heat and different materials.

Fig 3

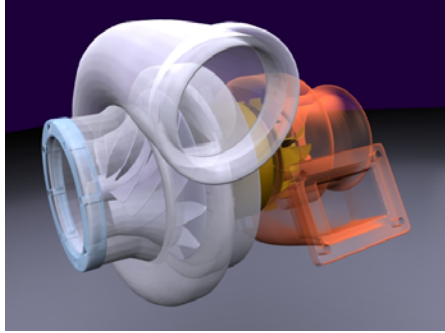


Fig 3: Each student will have a pre-modelled component on their own screen in which they can interact with.

Fig 4



Fig 4: Cross-sectional analysis will allow students to see the components internal parts ensuring a better understanding is gained.

Fig 5

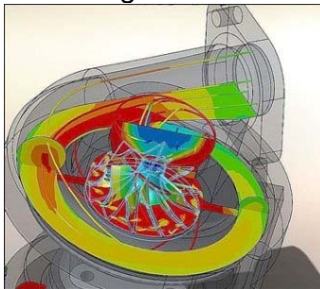


Fig 5: Additional knowledge which is not currently incorporated into the learning outcomes can easily be added to improve professional development. Thermal and airflow analysis, stress/strain and different material effects can be demonstrated with the click of a button.

Fig 6

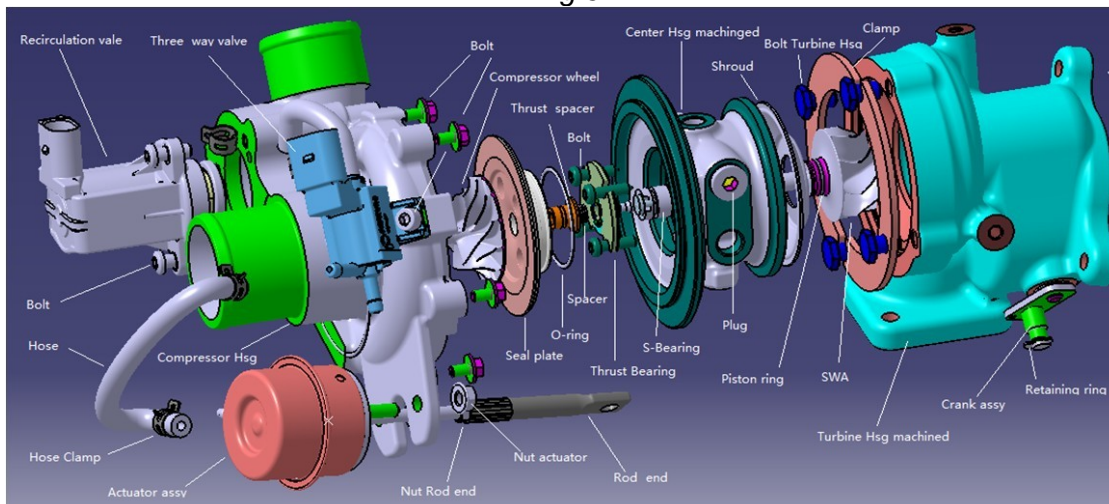


Fig 6: Showing components in exploded view saves the instructor time as students can learn to assemble the piece using the software prior to doing it physically on the workshop floor. Students can grasp a far better understanding of how all parts fit together to form a component.

Electrical Fitter (Elec Fit) and Electronic Technician (Elec Tech)

The Elec Fits are responsible for providing power, air conditioning and refrigeration on military operations. They specialise in circuitry and diesel generators and also have the ability to wire infrastructure much like an electrician.

The Elec Tech covers many of the same principles as the Elec Fit in terms of theory. Communication, optical and night vision equipments are imperative for conducting effective operations. The Elec Tech is the longest apprenticeship to complete, taking students approximately five years to become qualified.

Both trade groups cover many lessons whilst posted to TTS. The intent is to incorporate CAD software into these lessons so students can use pre-modelled electrical components and build basic circuit models using the software.

Example 2: Lesson 3.5.2 - Explain the 2 and 4 stroke cycles of operation.

The Objective of 3.5.2 is for students to demonstrate knowledge of the operating conditions for small motors (petrol and diesel).

Currently students are presented with a PowerPoint presentation prior to using training aids. TTS cannot afford training aids for every lesson.

Fig 7 – Four stroke petrol engine

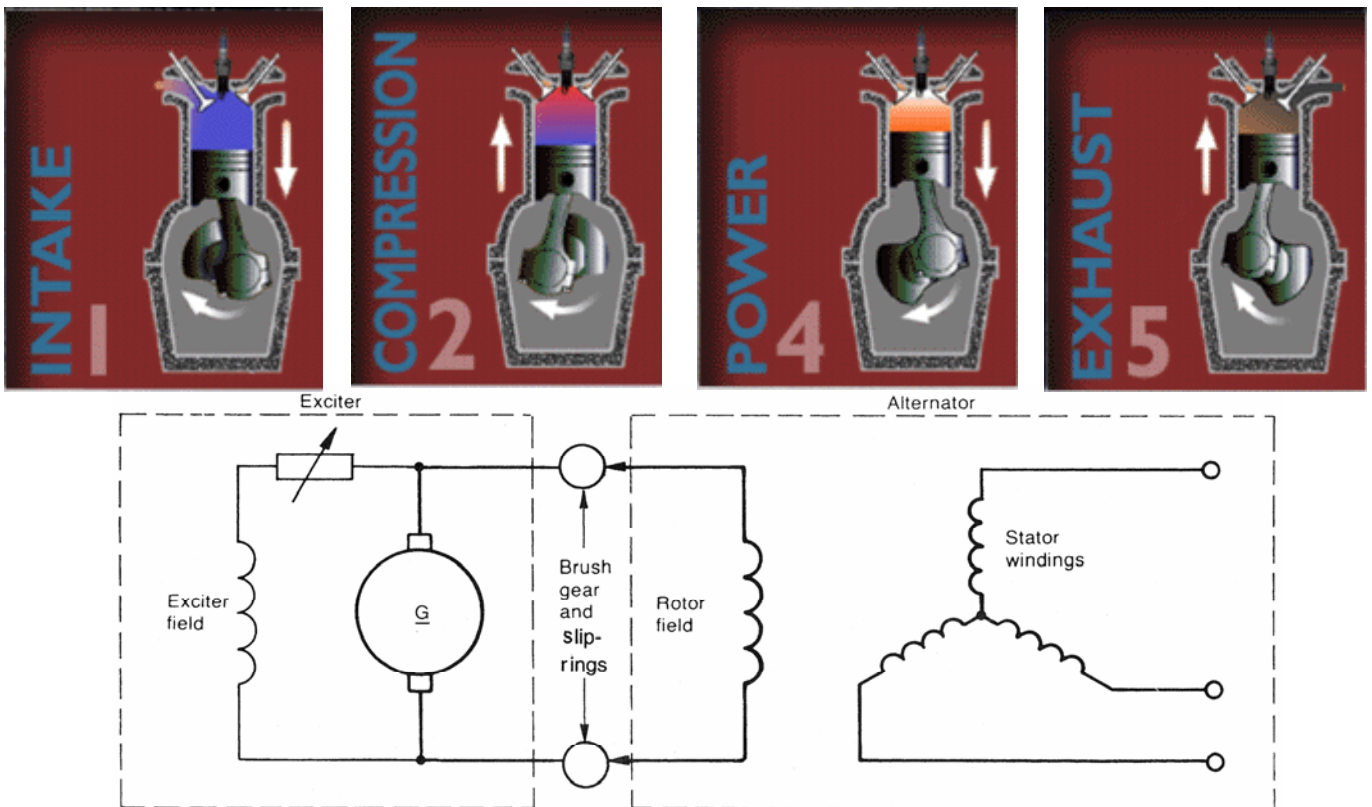


Fig 8 – Basic alternator circuit

Figures 7 and 8 display typical diagrams presented to students prior to working on the equipment on the workshop floor. These learning outcomes can be significantly improved with the utilisation of CAD software. Interaction with pre-modelled equipment can include and is not limited to:

- Using pre-modelled small engines to improve the delivery of the lesson plans in a similar approach to the Veh Mechs.
- Have students create their own circuitry systems (similar to Fig 6) using CAD software.
- Create circuits with 'problems' in which students have to identify and repair themselves.

Fig 9



Fig 9: Small 2 stroke engine with moving parts.

Fig 10

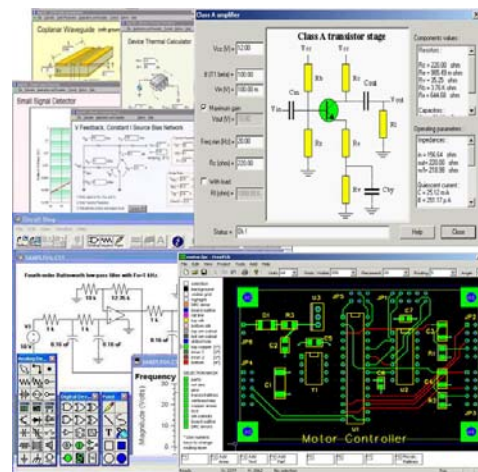


Fig 10: Comprehensive electrical circuit construction with tutorials.

Maintenance Fitter (Maint Fit) and Armourer (Armrr)

The Maint Fit trade is different in the fact that much of their work comes from making customised modifications to current equipments. This means that as a Maint Fit basic designing skills are needed to fulfil ones job requirement. Maint Fits become skilled at making components out of metal using lathes, mills and CNC machines. A large variety of welding techniques/methods are also mastered throughout the apprenticeship.

Armrrs have a very similar role when compared to Maint Fits however all their training focuses on all the weaponry the NZ Army utilises. Apprentices are taught how to machine and weld much like the Maint Fits. Armrrs also learn principles in the following subjects:

- Ballistics,
- Physics, and
- Material Science.

Both trade groups cover many lessons whilst posted to TTS. The intent is to incorporate CAD software into these lessons so students can design basic tools and components before manufacturing them themselves. These specific trades will also benefit from the plans that CAD can produce which students can actually take away to the workshop floor.

Example 3: Lesson 2.4.5 - Interpret technical drawings and tolerances.

Fig 11

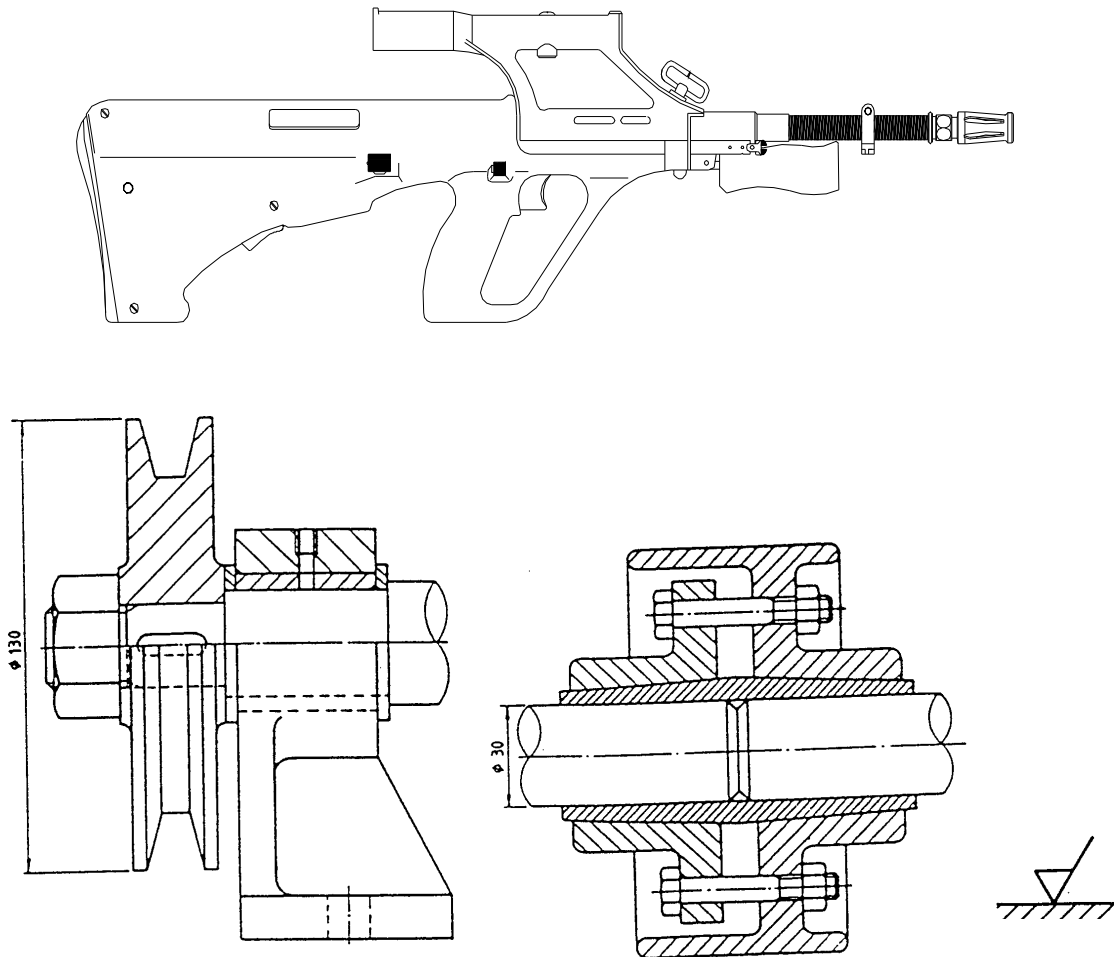


Figure 11 displays typical diagrams presented to students prior to working on the equipment on the workshop floor. These learning outcomes can be significantly improved with the utilisation of CAD software. Interaction with pre-modelled equipment can include and is not limited to:

- Utilise CAD to design basic components.
- Transfer CAD drawings onto a technical drawing prior to constructing the component on the shop floor. Incorporates the whole process from beginning to end product.
- Can show the different stresses and strains that pre-modelled equipments are under by simulating different operating conditions.
- Show how the component will operate when made out of different materials.

- Demonstrate the effect of heat treatment and different welding techniques on models as well as finite element analyses.
- Allows the user to see how much material is required for a certain job.

Fig 12

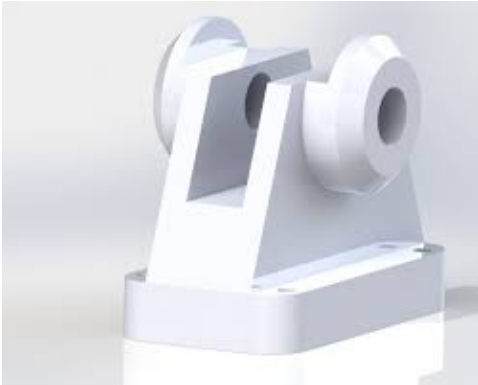


Fig 12: Design basic components. Measure material required for a job.

Fig 13

Fig 13: Stress/strain analysis on components.

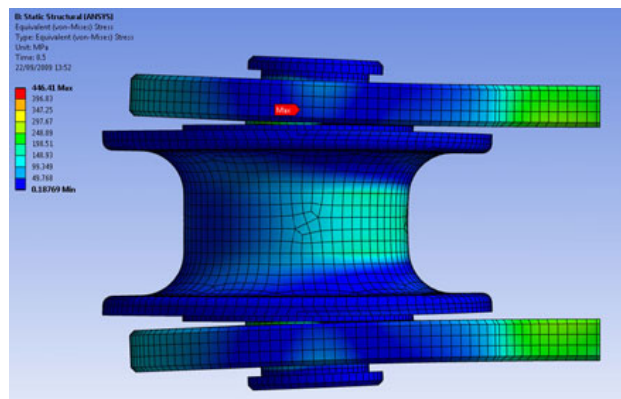


Fig 14

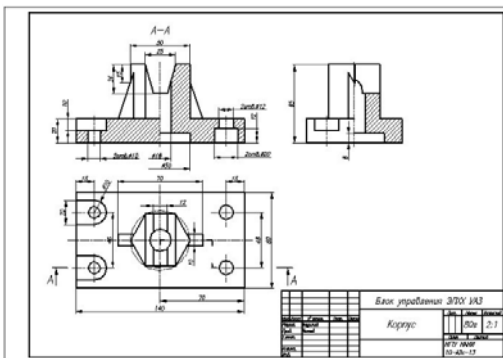


Fig 14: Construct technical drawings

Software Selection

A number of different programs were researched and trialled for the project. The program of choice was Autodesk Inventor Professional. The following reasons influenced the decision:

- Autodesk is very user friendly and has an excellent tutorial function.
- The Directorate of Land Engineering (DLE) utilises this software which means pre-modelled components can be easily transferred onto TTSS software.
- Autodesk Inventor has a 'lab setup cost' - this reduces the cost of the software significantly on the installation of 20+ computers.
- Can run motion simulations allowing models to move and function as they would in reality.
- The program of choice as rated by military personnel working at DLE.

In order to request software for use on military computers a procedure must be run by Communications, Information Systems (CIS) in order for the security implications to be compliant. This is due to some programs requiring constant internet access where user details are not secure. Due to this particular software having already being approved by CIS it avoids the effort of running through the process again saving both parties valuable time.

Security Implications

Conversations with DLE, CIS and Defence Security Bureau have concluded on the notion that there are no security implications in regards to using pre-modelled components from DLE of NZ Army equipment. This is taking into account that students at TTS have a minimum of Classified Vetting (CV) security clearance. A register in the classroom will be maintained by the instructors ensuring all students are up to date with their security vetting.

Risk Analyses

Reference Appendix E.

CAD SUITE DYNAMICS – STAGE THREE

Stage Three – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none"> Outline the physical elements of the CAD suite. 	<ol style="list-style-type: none"> Compare alternate options for the installation of a CAD suite e.g. size, location, employment, software. Recognise and comprehend any financial risks involved in the project.

Location

A room has been identified in the recently constructed Armrs building that would be suitable for use as the new CAD suite. Other options have been eliminated due to the following reasons:

- Motor Trade Classroom – not central, very far away from majority of TTS
- SAP classroom – Is used frequently by Supply Wing.
- Bluebell Room – Cannot accommodate enough computers.

The room chosen (which will now be referred to as the CAD Suite) sits on the second floor of the Armr building and is roughly 7m x 10m. It has ample room to fit 24 computer stations and already has a Projector setup which will save future spending. There is however some restricting factors that have been taken into account. Table 1 exhibits the advantages and disadvantages of the new CAD Suite location.

Table 2: Location benefits and constraints.

Advantage	Disadvantage
Ample room for 24+ work stations	Currently no Intranet ports. Cost + \$1850
Projector already setup. Cost – \$1000	Room very hot and stuffy. Cost + \$TBC
Central location and easy access	No Printer. Cost + TBC
Room currently does not have specialist function.	
Good lighting.	

Employment

There are a number of different employment options for running the CAD Suite. Due to CAD being a new software to TTS, not many instructors are familiar with how it operates. Instructors need to be trained and familiarised with the capabilities of the software and how to use it to an effective standard. The following options were considered for getting instructors up to the standard required to teach lessons to students using CAD software.

1. **Hire a fulltime staff member:** A hired employee would be in charge of training instructors and would be present during the entire lesson for technical troubleshooting. They would ensure the pre-modelled components were ready for use and could make changes for the instructor depending on the learning outcomes sought. This would be the most effective means however would cost the most to facilitate. A business case would need to be drafted for Trentham HR justifying the position before recruiting could occur. The SI MS can not justify hiring a fulltime employee for this job position.
2. **Contract CAD Specialist:** Having the same job role as option 1, a contracted employee will have the benefit of only residing at TTS for a short duration. This would allow them to teach the instructors enough in the first year for them to continue the training for other instructors that are posted into TTS at a later date. Again this is seen as an expensive option and will unlikely be approved.
3. **Design Train-the-Trainer course:** This option would see a course run at the start of the training year for all instructors involved in giving the new CAD lessons. It will present information on how to find particular components and run through the tutorial based learning package provided by the software. This is a cheap method and can still grant a very effective result to all personnel involved.
4. **Do nothing:** This option would put a lot more pressure on instructors. One of the justifications of the CAD suite is to take away some of the demands and stress from their current workload. In order for the CAD suite to be effective instructors must want to use it and if appropriate training is not provided then this could lead to apprehension. It is not fair to increase the workload of the current instructors as many of them are already working extra time in order to meet the organisations needs.

Option three has the most benefits in terms of cost and effectiveness of indoctrinating CAD into TTSs apprentice training framework and therefore been chosen as the option of choice. The SI MS has delegated the responsibility of designing the Train-the-Trainer Course for TTS. Lt Tavendale is an MS officer who is currently studying fulltime at WelTec and has had recent training on CAD software. His second year of study does not commence until 28 Feb 14 therefore he can be employed in the interim by designing this training package for the instructors. The Training package includes:

- A basic understanding of Autodesk Inventor and its capabilities,
- Training into specific trade related lessons (e.g. Veh Mechs, Elec Fits),
- Where to access different pre-modelled components,
- A run-through of the built-in tutorial, and
- A period for answering questions and common troubleshooting.

The responsibility for this training will be formally allocated to the second year WelTec Officer who will change from year to year. If there are no Officers posted to TTS who are undertaking engineering study, the responsibility will fall upon the SI MS to ensure this training is conducted.

Computers and hardware

The computer hardware for the CAD Suite was potentially the biggest cost involved with the initial setup. On the 13 Oct 13 the Simulation Centre in Linton Military Camp were handing back 20 computers to CIS as they were relocating and upgrading their current software. SI MS has managed to intercept this hardware prior to its reallocation and utilise it within the CAD Suite at TTS. Prior to the pick up, the specs of the new computers were checked, ensuring that they met the minimum requirements to run CAD software. This was an unplanned coincidence and TTS was more than happy to take advantage of this opportunity.

This has saved upwards of \$45,000 and has created a relatively large short-cut in regards to the approvals element of the project.

INDOCTRINATION OF LESSONS – STAGE FOUR

Stage Four – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none"> • Incorporate CAD into each trade groups training program. 	<ol style="list-style-type: none"> 1. Exchange ideas with the WO of each trade wing. 2. Design a training program for 2015 for each trade group using CAD. 3. Include a train-the-trainer program for current instructors.

The CAD Suite is going to be phased into the training programs for each trade over a number of years as instructors gain confidence in the new teaching methodology. Starting every lesson in the first year would create a large workload in preparing all the lessons. It is the SIs intent to have one lesson for each trade group conducted successfully in the CAD Suite in 2014. Phasing in this new technology will give instructors time to adapt and redesign their current lesson plans. Come 2015, the situation will be reassessed and more lessons incorporated into the training framework on a case-by-case basis.

The lessons that will be conducted in 2014 were chosen with guidance from the WO of each trade group. The lessons selected were as follows:

- **Veh Mech** – 5.1.3 An introduction to Turbo Chargers.
- **Elec Fit** – 3.5.2 Explain the 2 and 4 stroke cycle of operation.
- **Armr** – KHD207 Perform detailed strip and assembly of C9 Minimi Machine Gun.
- **Maint Fit** – 2.4.5 Interpret technical drawings and tolerances.
- **Elec Tech** – 1.3.2 Construct basic circuits (students will draw prior to soldering).

Train-the-Trainer Program

Reference Appendix F.

EMPLOYMENT OPTION FINALISED – STAGE FIVE

Stage Five – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none"> Finalise the employment option for the suite. 	<ol style="list-style-type: none"> Draft Business Case to attain remuneration package funding (TBC). Organise a train-the-trainer program during the months Jan/Feb 14(TBC). Recruit internally and expand current job description (TBC).

The hiring of personnel to run the CAD Suite cannot be justified as discussed in Stage Three. An extensive Train-the-Trainer course will be conducted in order for instructors to reach an adequate level of instructional ability.

CAD SUITE INSTALLATION – STAGE SIX

Stage Six – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none"> Setup of the suite. Purchase of additional materials. 	<ol style="list-style-type: none"> Contact CIS for the transport and installation of computer hardware. Ensure the suite has internet and intranet capability. Install selected software (specialist required TBC). Install training models onto the computers. Audio/Visual set up. Conduct an official opening.

Objectives

- Completed by CIS 20 Dec 13.
- Completed by CIS 14 Jan 14.
- Not Complete.
- Completed by Capt Vollebregt 20 Jan 14.
- Complete 13 Jan 14.
- Not Complete until software installed and trials concluded.

The current process for attaining funding for the CAD software has taken much longer than anticipated. The commanders involved have given their approval (CI TTS and LOTC

Commandant) however there is a multitude of administration staff that the Item Justification must be signed off by. This has delayed the initial installation of the software onto the computers that have already been set up.

The project will not be finished by the MEM deadline due to the failure in receiving the required funding on time. It is expected the IJ will be approved in full by the 15 Feb which will see the software purchased and installed in March 2014.

All other aspects of the project have been completed to a level where they are ready to be handed over to Capt Petre (incoming SI MS). Capt Vollebregt has given a detailed debrief and familiarised Capt Petre with the purpose and the need of the suite and is satisfied with the level of understanding that was received.

Capt Vollebregt will continue to finish the project after MEM requirements are completed.

CONCLUSION

CAD software is an excellent learning tool for students learning about mechanical/electrical components and technologies. Yao (2006 p.1) states that with a combination of visualisation, training, and operation, CAD is a very effective tool in a classroom environment. TTS is unique within industry due to the large amount of apprentices it teaches at any one time. This results in the classroom being the more preferred option for teaching, as it is much easier to present to large groups in this environment. Having an effective delivery system such as CAD in the classroom would obviously enhance learning outcomes at TTS.

Choosing a location for the CAD suite was of particular importance. A classroom in the Armourers building was chosen for its size, central location and availability. AutoDesk Inventor Professional was selected over a number of other options due to its compatibility with other Defence users. This allows TTS to utilise pre-modelled components from other institutions, which will be used in the lessons to the apprentices. The funding for the software is in the process of being approved and is being held up by administrative procedures. The total cost of the software is \$12,000 with an annual fee of \$1,300. The hardware was sourced free of charge.

Unver (2006) reinforces the fact that relying on the standard tutorial functions that come with CAD software can be an ineffective means of teaching students. The best way to teach CAD is to have an instructor in the classroom who can introduce the software and manage any troubleshooting that occurs. TTS identified early in the project that hiring a full or part time employee to manage the CAD suite would not be cost effective. For this reason a train-the-trainer package has been developed to ensure instructors at TTS are comfortable with CAD as a new teaching tool.

The teaching packages will be introduced into each trade group over the course of two years. In 2014 each trade will conduct one lesson for their students, using CAD as the teaching tool. In 2015 more lessons will be introduced into the curriculum as the instructors become more comfortable with the software. A 100% transition is not realistic and would put far too much pressure on TTS staff. 92% of the students have indicated that they are looking forward to this new training medium being implemented. This is a positive sign as they are ultimately the main focus of this project.

RECOMMENDATIONS

The following recommendations are documented for the purpose of ensuring future commanders at TTS are aware of the importance of this new teaching medium. Also included are proposals which require approval in order for the suite to be completed.

1. Capt Vollebregt is given approval to complete software installation from HQ JFNZ in order to see full completion of the project.
2. A minimum of one lesson from each trade group be incorporated into the training schedule in 2014 to ensure instructors become comfortable with the new software.
3. The 2015 training schedule designed by the WWO of each trade utilises the suite for the lessons provided by the SI MS.
4. In 2019 an assessment of the current software is carried out to see if new, more effective means of teaching students via computer based programming is being used in industry. This will ensure TTS remains modern and up to date in regards to teaching practices.
5. SI MS is given full responsibility of the room which includes:
 - Access approval for outside agencies,
 - Train-the-trainer lessons for new instructors posted to TTS,
 - Maintaining the room to a high standard,
 - Ensuring the learning outcomes of lessons are delivered to a high standard,
 - The renewal of the licensing fee is paid on time every year, and
 - Pre-modelled drawings are received when new equipment enters the NZ Army.
6. Students are given access to the room in order to complete personal administration and to utilise the CAD software in their own time for professional development.
7. Second year WELTEC students are utilised in the semester breaks to run Train-the-trainer courses for instructors who are posted in or need re-familiarisation.
8. The CI (on behalf of TTS) selects a name for the room and announces it at the official opening in Mar 14. A plaque is made up by Maint Fit wing to put on the entrance.
9. An evaluation of the effectiveness of the CAD Suite be conducted at the conclusion of 2015 (first full training year).
10. A printer is purchased for the ability to print technical drawings.

Summary of Costing

Item	Cost
AutoDesk Inventor Professional	\$12,000
Licensing Fee (annual)	\$1,300
Hardware	Nil Cost
Cables	\$150.00
Total	\$13,450

REFERENCES

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DFO 16 Civil Staff and Human Resource Policy.

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DFO 51 (1) Protective Security, Chap 6, Classified Information.

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DFO 102 Use of Communications and Information Systems.

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REFLECTIVE SUMMARY

Ethical Considerations

Instructing staff at TTS are often under a lot of pressure due to the shortage of instructors within NZ Army. It was very important during this project that instructors were included in the design and implementation of the CAD Suite. One of the sole reasons the suite was constructed was to alleviate some of the strain already bestowed upon the instructors – not to add more. If at any point it was discovered that this would apply too much pressure, the Stage Gate Model would have seen a revision or halting of the project. The instructors at TTS are looking forward to this new teaching medium as it has a lot to offer in terms of innovation and interaction.

Innovative Recommendations

The project in its entirety is an innovative way in which to train apprentices in a classroom environment. One of the challenges TTS faces is teaching civilian qualifications to students in a military environment. The CAD suite will allow a more seamless transition by utilising technology as a teaching tool. 'Generation Y' students have shown a positive reaction to the introduction of computer based programming so it is important TTS uses this to its advantage.

It is recommended that students are continually encouraged to use the suite in their spare time for professional development and familiarisation of the software. It is highly likely that some of the current students will be posted to TTS as instructors in 10-12 years time so it is paramount they become proficient.

Personal Summary

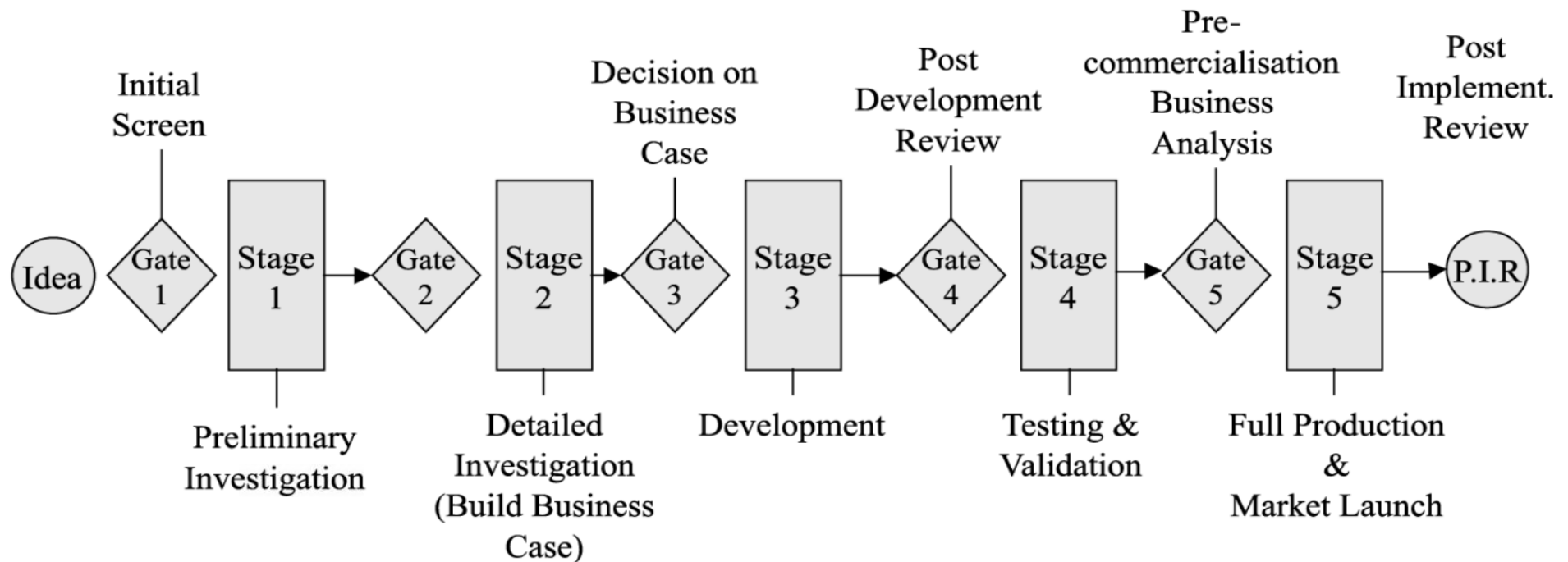
Training soldiers in the NZ Army is a passion I will take with me wherever I go within the organisation. It gives me great satisfaction to see skills learnt that can be taken away and utilised in an operational setting or just in the work place in general. I have worked with multiple militaries around the world and the NZ Soldier still stands out as the most adaptable in terms of keenness to learn and ability to learn.

In terms of teaching theory to students, it is far more challenging than some of the other more exciting aspects of military life. I believe institutions like TTS should make it as interesting and interactive as possible for the students – keeping them engaged and stimulated. I believe the CAD training we have implemented into each trade group will have very positive effects in how students gain and retain knowledge.

I do not believe I have experienced the most rewarding part of this project yet as the funding still has to come through for the software. As soon as the first lessons are integrated into the training schedules I will be satisfied. It was very challenging for me to deal with continual delays and dealing with the burgeoning administrative empire that the NZ Army has established in some dark lair that I could not locate for the life of me. It can be accurately stated that my patience was tested on more than one occasion. I would like to say thank you to Maj Corke who was very enthusiastic about the project and who obviously shares a passion for training soldiers.

The Stage-Gate Model

The Stage-Gate model is a project management tool or technique in which a project or initiative is divided into phases. At the conclusion of each stage a 'gate' must be passed in order to carry on to the next stage. The gates are the decision points and if they are not passed the project is scrapped.



Source: Cooper (1994)



Project Charter Document

Organisation: New Zealand Army
Department: Trade Training School (TTS)
Focus Area: Maintenance Support Apprenticeship Training
Product/Process: Investigation into the justification and implementation of Computer Aided Design (CAD) software into TTSs apprentice training framework.

Prepared By

Document Owner(s)	Project/Organisation Role
Benjamin Vollebregt	<ul style="list-style-type: none">• Master of Engineering Management (MEM)• Senior Instructor TTS 7 Oct – 15 Dec 13• J4/3 Joint Force Headquarters 16 Dec 13 – TBC.

Project Charter Version Control

Version	Date	Author	Change Description
1.0	13 Oct 13	Benjamin Vollebregt	Document created
1.1	15 Oct 13	Benjamin Vollebregt	Update risk assessment criteria

AIM

The aim of the project is to improve the efficiency of apprenticeship training at Trade Training School (TTS) utilising CAD software as a new means of conveying information to students.

OBJECTIVE

The objective of the project is to investigate the feasibility of installing a CAD suite at TTS and using this as a new teaching medium. More efficient teaching methods are required at TTS as many instructor para-lines remain vacant due to retention issues and lack of qualified personnel. The project will also provide an opportunity to utilise and apply management principles recently attained throughout the MEM.

Justifications for installation of a CAD suite include:

- More efficiently teach large groups of students.
- In accordance with the Chief of Army's intent, continue to foster and support innovative thinking and development.
- Continue to implement and use modern teaching practices.
- Utilise the suite in a secondary role as the student's administration room.
- Ensure TTS remains the centre of excellence for engineering development within the NZ Army.
- Save costs on training aids which typically cost upwards of \$10,000.

BACKGROUND

TTS trains and equips all Royal New Zealand Army Logistic Regiment (RNZALR) soldiers in the NZ Army with the logistical skills required for operational deployment and garrison duties. TTS is made up of five wings:

- Movements Wing.
- Transport Wing.
- Supply Wing.
- Driver Training Wing, and
- Maintenance Support Wing (MSW).

MSW is the focus of this project charter. MSW is responsible for the training of five Maintenance Support (MS) apprentice groups, these being Armourer, Electronic Technician, Maintenance Fitter, Vehicle Mechanic and Electrical Fitter.

Currently the instructor / student ratio is not favorable for TTS as only 66% of all the training staff roles are occupied. More pressure is put on these individuals because the output for quality and quantity of apprentices remains unchanged. TTS is continually researching new, more efficient means of teaching students. The Chief Instructor (CI) of TTS has authorised the request for an investigation into the installation of a CAD suite. The investigation is to include the following:

- Effectiveness of CAD as a new training medium,
- Benefits and constraints bestowed upon the unit,
- Cost analysis,
- Indoctrination into current apprenticeship training framework,
- Employment (include Business Case if required), and
- Software selection.

Traditional apprentice training is normally conducted one-on-one between the student and an immediate supervisor. At TTS training is conducted in groups, with an instructor formally giving lessons and demonstrating hands-on skills before student's under-go tasks themselves. Due to the shortage of instructors this can be quite difficult to achieve. It is not the anticipation for the students to learn how to design components but to construct systems utilising pre-designed models (such as an engine) and circuitry.

PROJECT SCOPE

Utilising the Stage-Gate process for the project (see Appendix A) the proposal will be broken down into the following stages:

Stage One – Investigating current training performance

The first stage of the project will be the analysis of the existing training program for each different MS apprentice group. In order for improvements to be made, a clear understanding of the current learning outcomes and deficiencies must be clearly defined. This is important otherwise any new process put in place could have the same limitations as the current one.

Each trade group has a Warrant Officer (WO) in charge of the training and training budget so a cost analysis for each wing will also be established in order to see where costs can be saved. The WO in charge of each trade wing has a minimum of 15 years' experience in the particular trade they are in charge of. It is anticipated that they will provide a wealth of knowledge into the current training regimes.

Stage One – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none"> • Analysis of current training regime for each trade group. • Cost analysis of the training budget. 	<ol style="list-style-type: none"> 1. Attain a clear understanding of current learning outcomes. 2. Understand where current deficiencies reside. What effect does the training staff shortage yield? 3. Identify and understand the current expenditure process in place within MSW.

Stage Two – Investigate the feasibility of CAD as an effective teaching medium

Stage two will focus on how CAD can be used as an effective teaching tool for MS apprentices within the NZ Army. Students are expected to understand the theory of their

individual trade groups not just how to insert part A into part B. This is due to the complexities of modern warfare where the correct parts or procedures cannot always be put in place because of restricting factors in the battle space.

During this stage different CAD software's will also be researched and a location for a suite (if justified) will be identified. Contact with equivalent trade schools in foreign militaries will be established in order to seek ideas and compare training philosophies. CAD suites at nearby institutions (such as WELTEC) will be analysed and interviews with their training staff conducted in order to learn best practice in this new teaching environment.

The possibility of gaining clearance to use actual CAD drawings of current NZ Army military equipment will also be investigated. Many CAD drawings of NZ Army equipment will already be drafted by the Directorate of Land Engineering (DLE). The security implications of using these drawings will need to be identified and authorised by Capability Branch and DLE.

During this stage, different options based on size, location, employment and software of the suite will be investigated and a risk analysis will be conducted.

Stage Two – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none">• Research CAD as a teaching tool for apprentices.• Document risks and report to CI.• Construct PowerPoint on findings thus far for ENMG608.	<ol style="list-style-type: none">1. Identify how each trade group could utilise CAD as a training tool.2. Research the different software available.3. Understand how other training institutions are currently operating.4. Identify whether other units have drawings available and if so the security implications of using them.5. Analyse the risks involved for the project.

Stage Three – Cost Analyses

This stage sees a full cost analyses taking place for the installation of a CAD suite at TTS. Included will be a cost-benefit analyses between different options which will be established in stage two. Stage three will:

- Determine if it is a sound investment/decision.
- Provide a basis for comparing options. This involves comparing the total expected cost of each option against the total expected benefits to see whether the benefits outweigh the costs and by how much.
- Determine risks involved.

Stage Three – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none">• Perform a cost analysis on different options.	<ol style="list-style-type: none">1. Compare alternate options for the installation of a CAD suite e.g. size, location, employment, software.2. Recognise and comprehend any financial risks involved in the project.

Stage Four – Indoctrination into the apprenticeship training framework

Prior to any purchases or installations taking place, the integration of the new learning tool must be put in place within the current training program for each trade group. This is conducted after the cost analyses as it would be a waste of time completing if the project was not going ahead because of financial reasons.

This stage is expected to be a laborious exercise, as training staff will have to learn the capabilities of CAD software so as to understand what training can be transferred to it. Each trade group's program will have to be analysed in order to see which training can be transferred and designed in a way so classes between trade groups do not clash. It is expected that some staff will have an unwillingness to adopt modern learning techniques - using computers as the interface - so it is crucial the benefits are conveyed clearly.

Stage Four – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none">• Incorporate CAD into each trade groups training program.	<ol style="list-style-type: none">1. Exchange ideas with the WO of each trade wing.2. Design a training program for 2015 for each trade group using CAD.3. Include a train-the-trainer program for current instructors.

Stage Five – Business Case and employment options finalised

By stage five, the understanding of how the suite will be utilised will have been established. During Stage two, the investigation of the employment of a specialist instructor (civilian) will have taken place. In order to hire additional staff within the NZ Army a Business Case must be drafted in order to gain the funding to pay salary as this does not come from TTSs budget. Stage five will see the completion of this if necessary. It may be the case that TTS already has the employees with the skills internally and are just not utilising them.

There are three options for the completion of stage five:

- Draft a Business Case for a specialist to run the suite.
- Recruit internally an individual who has experience in CAD and broaden their job description.
- Run a 3-4 day training program (using staff from WELTEC or DLE) at the start of the training period each year (train the trainer).

Stage Five – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none"> • Finalise the employment option for the suite. 	<ol style="list-style-type: none"> 1. Draft Business Case to attain remuneration package funding (TBC). 2. Organise a train-the-trainer program during the months Jan/Feb (TBC). 3. Recruit internally and expand current job description (TBC).

Stage Six – Installation of the CAD suite

Communications & Information Systems (CIS) will be used for delivery and installation of computer hardware. Utilising CIS will be the most cost effective option and will only involve the transfer of funds into another cost center. It is anticipated that the suite will have a secondary use as a space for soldiers to do their personal administration thus the need for internet and intranet setup involving CIS specialists.

Due to the research required in the previous stages, details such as the location and software installation cannot be defined at this point in time.

During this stage the models needed on the CAD software will be downloaded onto the computers from internet sources and DLE (TBC).

The suite will require additional resources such as PowerPoint projector, desks/chairs etc.

Stage Six – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none"> • Setup of the suite. • Purchase of additional materials. 	<ol style="list-style-type: none"> 1. Contact CIS for the transport and installation of computer hardware. 2. Ensure the suite has internet and intranet capability. 3. Install selected software (specialist required TBC). 4. Install training models onto the computers. 5. Conduct an official opening. 6. Audio/Visual capability setup.

Stage Seven – Implementation and validation

The final stage of the project concludes with the handover of the suite to the training staff and the commencement of the recently designed training program. The 2014 training program has already been funded so the CAD suite will not be fully utilised until 2015. A validation will be conducted of the suite and training schedule after three months of its operation.

Stage Seven – Goals and Objectives

Goals	Objectives
<ul style="list-style-type: none">• Conduct validation after three months of operation.• Complete MEM requirements for ENMG608.	<ol style="list-style-type: none">1. Correct deficiencies if there are any identified.2. Summarise key findings and initiatives.3. Provide the CI with an overview of completed tasks.4. Complete project report.

Statements of Work (SOW)

Table One outlines the primary tasks, milestones and deliverables associated to the project.

Table One: Milestones and Deliverables

Task Number	Task Name	Task Details	Milestone Date	Deliverable Details
1.0 Stage One: Investigate Current Training Performance				
1.1	Understand current procedure.	Spend a day in each trade wing.	8 Nov 13	<ul style="list-style-type: none"> Learning each trades training outcomes. Capture feedback for improvement
1.2	Cost analyses.	Preparation of expenditure model.	9 Nov 13	<ul style="list-style-type: none"> Create model to compare each trades costs.
1.3	SWOT analyses	Assess the current strengths, weaknesses, opportunities and threats.	13 Nov 13	<ul style="list-style-type: none"> Produce SWOT model.
1.4	Lesson transfer	Identify what lessons could be transferred to CAD.	18 Nov 13	<ul style="list-style-type: none"> Potential lesson list developed.
2.0 Stage Two: The feasibility of CAD as a teaching medium				
2.1	CAD programs	Identify different CAD programs available.	20 Nov 13	<ul style="list-style-type: none"> Research different available software. Investigate case studies for all programs identified.
2.2	Contact trade schools	Liaise with trade school equivalents in both the military and civilian sectors. Domestic and international.	22 Nov 13	<ul style="list-style-type: none"> Contact Australian Army TTS and learn their procedure. Visit to WELTEC to attain knowledge in CAD teaching methodology.
2.3	Location	Identify location options.	23 Nov 13	<ul style="list-style-type: none"> Identify what classrooms are used the least within MSW. Produce location plan to CI.
2.4	Pre-made models	Investigate feasibility of using pre-made military CAD models.	28 Nov 13	<ul style="list-style-type: none"> Ascertain whether models are available from DLE. Contact DLE and analyse security implications.

				<ul style="list-style-type: none"> • Contact Capability Branch and discuss security implications. • Draft report on findings.
2.5	Suite size	Decide the suites size (number of computer stations)	30 Nov 13	<ul style="list-style-type: none"> • Identify the size requirements for the suite including: <ul style="list-style-type: none"> ○ Number of computer stations. ○ Layout ○ Additional furniture ○ Additional accessories
2.6	Risk analysis	Conduct risk analysis	2 Dec 13	<ul style="list-style-type: none"> • Document risk analysis results
3.0 Cost Analyses				
3.1	Software selection	Obtain quote for selected CAD software package.	3 Dec 13	<ul style="list-style-type: none"> • Document all costs associated with project.
3.2	Computer installment	Obtain quote for computers and computer installation.	4 Dec 13	<ul style="list-style-type: none"> • Document all costs associated with project. • Ensure computers can run with software specifications.
3.3	Room layout	Obtain quote for furniture and any additional resources required	5 Dec 13	<ul style="list-style-type: none"> • Document all costs associated with project.
3.4	Training/employment	Obtain quote for the costs for additional employment of staff and/or training.	9 Dec 13	<ul style="list-style-type: none"> • Document all costs associated with project.
3.5	Cost assessment	Complete the cost assessment	14 Dec 13	<ul style="list-style-type: none"> • Present cost assessment to CI, • Be prepared to discuss alternate options.
4.0 Indoctrination of CAD into training framework³				
4.1	Train the trainer - Part One	Prepare and give presentation on the capabilities of CAD to TTS staff.	16 Dec 13	<ul style="list-style-type: none"> • Ensure understanding of capabilities to all instructors. • Have a demonstration set up.
4.2	Armourer lesson plan	Incorporate CAD into Armourer training program.	18 Dec 13	<ul style="list-style-type: none"> • Finalise 2015 Armourer training schedule.
4.3	Maintenance Fitter Plan	Incorporate CAD into Maintenance Fitter training program.	19 Dec 13	<ul style="list-style-type: none"> • Finalise 2015 Maintenance Fitter training schedule.

³ Due to current workload, stage 4 is likely to finish early 2014; however the intent is still to finish by end of Dec 13.

4.4	Electronic Technician plan	Incorporate CAD into Electronic Technician training program.	20 Dec 13	<ul style="list-style-type: none"> Finalise 2015 Electronic Technician training schedule.
4.5	Vehicle Mechanic plan	Incorporate CAD into Vehicle Mechanic training program.	21 Dec 13	<ul style="list-style-type: none"> Finalise 2015 Armourer training schedule.
4.6	Electrical Fitter Plan	Incorporate CAD into Electrical Fitter training program.	22 Dec 13	<ul style="list-style-type: none"> Finalise 2015 Armourer training schedule.
4.7	Train the trainer – Part Two	Design Train the trainer course	5 Jan 13	<ul style="list-style-type: none"> Finalise Train the trainer course. Include <ul style="list-style-type: none"> Instructor (WELTEC?) Students Size of course Ideal time frame Frequency
5.0 Suite responsibility, employment and control				
5.1	Present options	Draft options into a document for CI to consider.	7 Jan 14	<ul style="list-style-type: none"> Options include but are not limited to: <ul style="list-style-type: none"> Employ specialist to run suite. Internal recruiting. Current staff learn how to adequately use CAD in their lessons.
5.2 TBC	Recruit TBC	Draft Business Case for employment or re-format current job description for internal recruitment.	8 Jan 14	<ul style="list-style-type: none"> Submit Business Case.
6.0 Installation of CAD suite⁴				
6.1	Transport and setup	Order computers and furniture for suite.	14 Jan 14	<ul style="list-style-type: none"> Organise setup using current students and CIS. Ensure computers and software are compatible.
6.2	Software installation	IT specialist to install software TBC	15 Jan 14	<ul style="list-style-type: none"> Ensure computers are running to standard.
6.3	Download models	Research and download the models required for CAD lessons respective of trade.	28 Jan 14	<ul style="list-style-type: none"> Download models required. Draft models required if not already designed. Retrieve CAD drawings from DLE (TBC).

⁴ Timings for Stage 6 are very flexible and are only used as a guideline.

6.4	Additional materials	Install any additional tools or materials e.g. PowerPoint projector	1 Feb 14	<ul style="list-style-type: none"> Complete suite setup.
7.0 Implementation and Validation				
7.1	Corrections	Remedy any deficiencies identified.	10 Feb 14	<ul style="list-style-type: none"> TBC
7.2	Summarise	Provide CI with overview of project	11 Feb 14	<ul style="list-style-type: none"> Present findings via PowerPoint presentation.
7.3	Complete	Finish drafting MEM report	18 Feb 14	<ul style="list-style-type: none"> Ensure draft submitted by 1 Feb. Finalised version complete no later than 18 Feb.

Project Deliverables

Milestone	Date achieved by:
1. Stage One	<ul style="list-style-type: none"> 18 Nov 13
2. Stage Two	<ul style="list-style-type: none"> 02 Dec 13
3. Stage Three	<ul style="list-style-type: none"> 14 Dec 13
4. Stage Four	<ul style="list-style-type: none"> 22 Dec 13
5. Stage Five	<ul style="list-style-type: none"> 08 Jan 14
6. Stage Six	<ul style="list-style-type: none"> 01 Feb 14
7. Stage Seven	<ul style="list-style-type: none"> 18 Feb 14

Deliverables Out of Scope

Date	Milestone	Deliverable
27 Nov 13	Industry Presentation	<ul style="list-style-type: none"> PowerPoint presentation; Investigation into the justification and implementation of CAD software into TTSS apprentice training framework.
15 Jan 14	Strategic Management	<ul style="list-style-type: none"> Individual University Assignment
18 Feb 14	Project	<ul style="list-style-type: none"> Hand in project report

PROJECT CONDITIONS

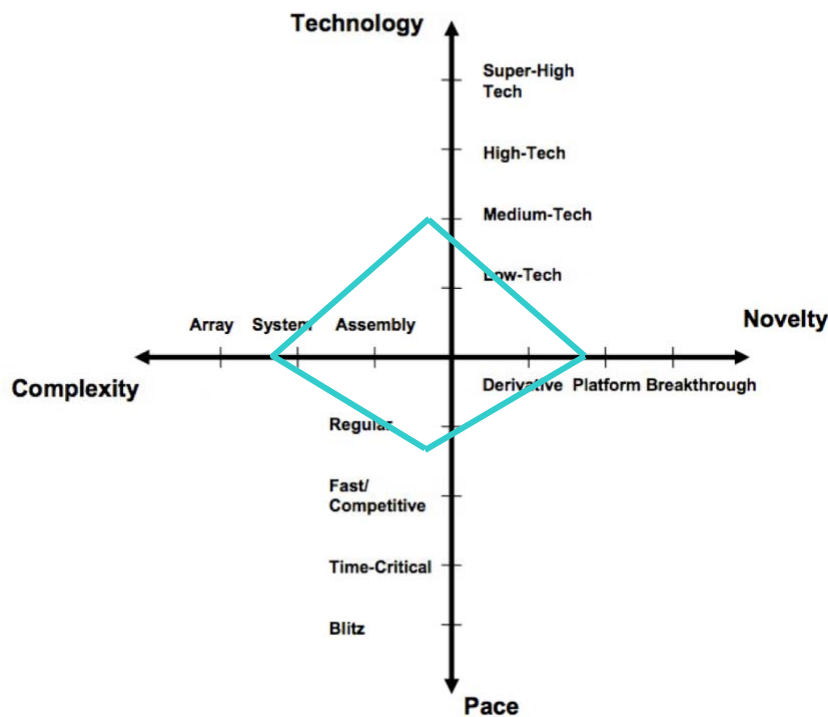
Project Assumptions

- Captain Vollebregt is posted to Headquarters Joint Forces New Zealand on the 15 Dec 13. A discussion with his future superiors has yet to take place on how much time he can allocate to the project per day.
- Leave plans for personnel involved in the project are not due to be submitted until 1 Nov 13. Some timings may need to be altered after this date.

Diamond Model

The following risk assessment is a Novelty, Technology, Pace and Complexity (NTPC) diamond model. It is used to describe the challenges the project presents and how these will affect the success of the project.

Fig 1: NTPC Diamond Model



Complexity

Complexity is defined by how the project is organised, its scope and the interconnection between project elements. This project is defined as a system as it encompasses majority of the stakeholders within the MSW at TTS. It has the potential to modify how day to day business is run and how maintenance support is conveyed to soldiers within the NZ Army.

Technology

Technology is defined as the initial uncertainty centered on a technologies development, maturity and knowledge. As technical uncertainty increases so do requirements for technical and professional skills, development efforts and time for completion, communication and the impact /significance of project results (Brian. J Sauser). Whilst the technology and maturity of CAD is quite well established within industry, it is not so within TTS. The knowledge factor of this dimension sits at medium due to the fact it has not been used before. Installing a CAD suite at TTS does not upload a new capability for the NZ Army – only with the addition of knowledge does this become a valuable tool.

Novelty

Novelty is defined by the products uniqueness to the market. In this case the project is measured as a platform within a military environment. Whilst this product may be common in universities and polytechnics - it is not so within the New Zealand Defence Force (NZDF). Knowledge from these educational facilities will be used to ensure that TTSS end product matches or exceeds these current platforms within industry.

Pace.

Pace is defined by the urgency and criticality of time goals for a project. Time constraints on a project can dictate varying project structures and management attention. The project aims to change the training schedule of the 2015 soldier intake. The project is being conducted a year early (partly for university requirements) to ensure that staff have enough time to effectively incorporate their lessons into the new training medium. It will also give them time to familiarise themselves with the software and its functions/capabilities.

Project Duration

The duration of the project will be from 20 Oct 13 until 15 Feb 14 (approx). Throughout the project time will be allocated to document any activities that have taken place for the project report required by the university.

A work breakdown for the project has been formed to map the critical path that must be considered through the project duration. A Gantt chart can be found in appendix B.

Activity (see SOW)	Hours
1.0 Stage One	103hrs
1.1 Understand current procedure	40 Hrs
1.2 Cost analyses	5 Hrs
1.3 SWOT analyses	8 Hrs
1.4 Lesson transfer	50 Hrs
2.0 Stage Two	75 Hrs
2.1 CAD Programs	15 Hrs
2.2 Contact trade schools	10 Hrs

2.3 Location options	5 Hrs
2.4 Pre-made models	20 Hrs
2.5 Suite size	5 Hrs
2.6 Risk analyses	10 Hrs
3.0 Stage Three	80 Hrs
3.1 Software selection	10 Hrs
3.2 Computer installment costing	5 Hrs
3.3 Room layout	5 Hrs
3.4 Training/employment	30 Hrs
3.5 Cost assessment	30 Hrs
4.0 Stage Four	144 Hrs
4.1 Train-the-Trainer Dev (part 1)	10 Hrs
4.2 Armourer lesson plan	20 Hours
4.3 Maintenance Fitter lesson plan	20 Hours
4.4 Electronic Technician lesson plan	20 Hours
4.5 Vehicle Mechanic lesson plan	25 Hours
4.6 Electrical Fitter lesson plan	20 Hours
4.7 Train-the-Trainer (part 2)	30 Hours
5.0 Stage Five	12 Hrs
5.1 Present options	12Hrs
5.2 Recruit (TBC)	TBC
6.0 Stage Six	105 Hrs
6.1 Transport and setup	30 Hrs
6.2 Software installation	8 Hrs
6.3 Download/draft models	60 Hrs
6.4 Additional materials	7 Hrs
7.0 Stage Seven	155 Hrs
7.1 Corrections	5 Hrs (TBC)
7.2 Summarise	20 Hrs
7.3 Complete report	140 Hrs
Total Hours	684 Hrs

PROJECT STRUCTURE APPROACH

The Stage-Gate model is being utilised for the duration of the project (see Appendix A). After each stage is complete, a review will be conducted (at the gate). At each gate there are three main points for discussion:

- Quality of execution
- Business rationale
- Action plan

Quality of execution: Checks whether the previous stage was conducted in a satisfactory fashion.

Business rationale: Does the project continue to look like an attractive idea or business opportunity?

Action plan: A review of the next stage which includes the deliverables and outputs.

At each gate the project can have four alternate results:

- Kill
- Go
- Hold
- Recycle

The Stage-Gate model is being utilised due to its ability to produce quick results in a logical manner. It also allows a project to be entirely investigated before funding is spent. This ensures that no capital is wasted if a project is turned down before its concluding stages.



Progress Reports

A report will be raised to record, monitor, provide recommendations and gain approvals prior to implementation. Regular updates will be communicated to the project supervisor both at staff conferences on a weekly basis and through regular email updates.

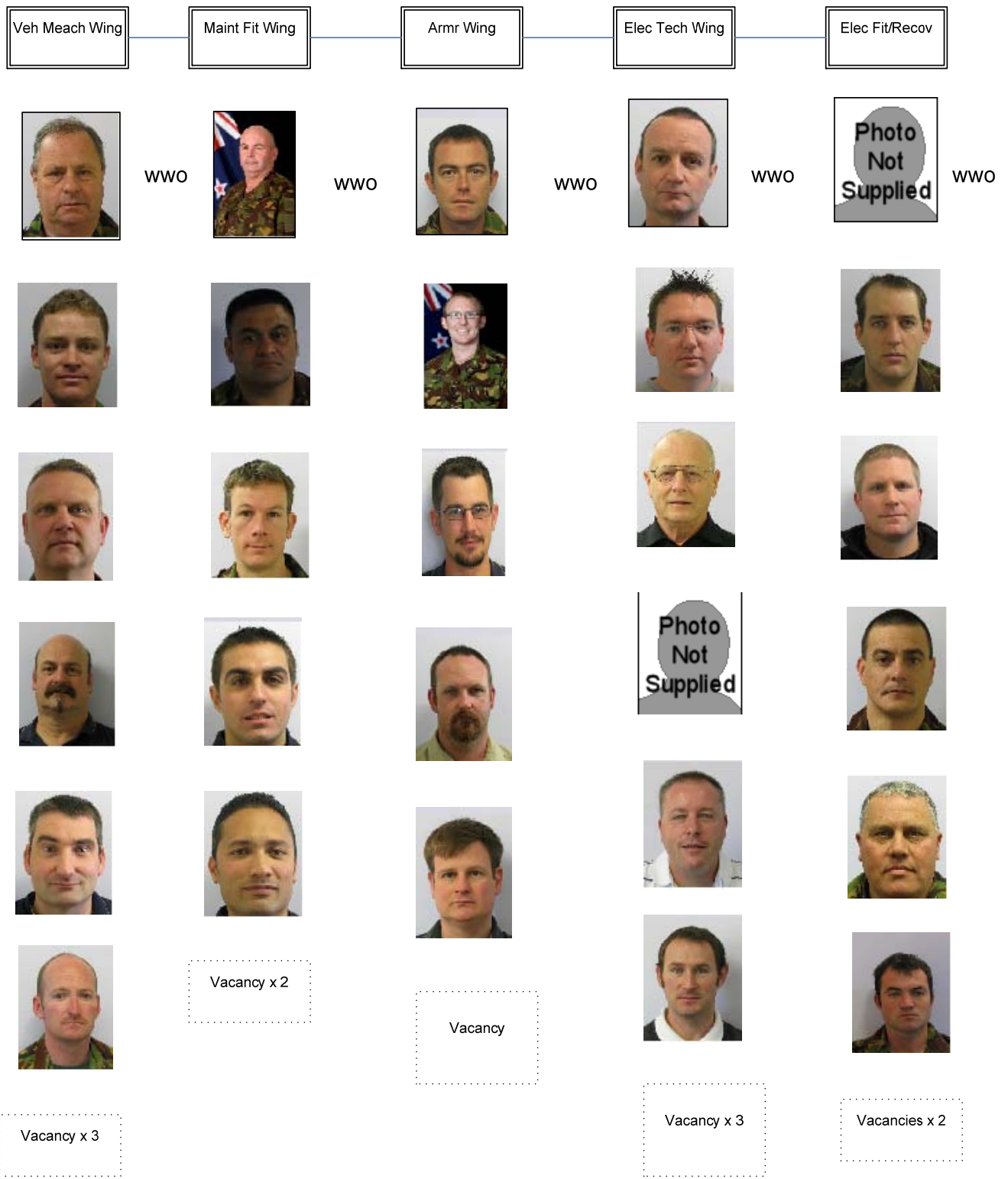
Communication between departments and with other key stakeholders will be reported on a case by case basis and as required.

MSW Org Chart As at 5 Dec 13



SI MS (CAPT)
Capt Vollebregt

Appendix C



AFNZ 975

Item Justification New Zealand Army

Appendix D

Version May 2011

Unit IJ Number: 001									
Purchase Approval <input type="checkbox"/>		NZET Change		Headquarters Use Only					
Unit: LOTC		Sub Unit: TTS			Register No Date				
CC No: 43233		SPC/Vendor No : See Detail		Formation					
Part 1: Detail (Full NIIN/Description of Equipment or Service)				Comd HQ					
Autodesk Product Design Suite Ultimate 2014 x 20 (\$415 each) = \$8300.00									
Autodesk Product Design Ult Subs – New x 20 (\$65.00 each) = \$1300.00									
GST = \$1440.00									
Qty: see detail	Price Ea: see detail	Total Cost: \$11040.00	Date reqd by: 15 Jan 14	No of Sheets:					
CES or Kit No: See detail			Fixed Asset: No						
Equipment previously used		Nil, adhoc classrooms with multiple students to a computer.							
Part 2: NZET Equipment Distribution									
NIIN's (Mat Nos)	Description(s)	Unit (NZET name)	Coy	OLOC		DLOC		ALOC	
				Curr.	Prop.	Curr.	Prop.	Curr.	Prop.

*****Note: for changes to a TOE distribution within the unit only - use the AFNZ975A*****

Part 3: ITEM/DEMAND JUSTIFICATION (continue on a cover letter if more space is required)

Unit Comments: The Role this equipment/capability is required for:

With the progress of technology and development of training and training aids there is now a requirement for tradesmen to conduct computer based learning as part of their apprenticeship. The VM trade in particular often has a requirement to conduct computer based lessons for a large number of students.

FM and CIS branch have approved the installation and Works Order for the wiring of the Weapons Wing upper and lower class rooms. The upper class room is capable of accommodating 20 work stations, and the lower class room 10 work stations. The upper class room is intended to become a technical learning computer suite where tradesmen can sit with 1 computer per student and enhance their leaning through computer based programs. The M91P computer has sufficient specs to run the AutoDesk Student Software.

How will this equipment/capability improve Unit Efficiency:

TTS currently has just one large computer room, the 'Large SAP Suite', capable of accommodating more than 12 students on computers. Both the Supply Wing and Motor Trades Wing vie for the use of this facility. With the stand up of TES Planning and Scheduling this resources is often occupied by a range of additional courses both internal and external to TTS forcing students to at times work 2-3 to a computer in alternate computer rooms.

The use of AutoDesk Student Software will provide a cost effective platform and additional tool for MS Wing instructors to teach complex mechanical systems. By utilising a computer based model that can be manipulated and modified by each student it will enhance their comprehension of evolving and progressively complex systems.

Part 4: Unit Approval

Originator B. Vollebregt	Rank Capt	Signature	Appt: SI MS WING	Date 3 Nov 13	Phone 347 7526
CCM/AO Name P. Corke	Rank Maj	Signature	Appt: CI TTS	Date	Phone 347 7544
CO Name R. Margetts	Rank Lt Col	Signature	Appt:	Date	Phone
Unit Operating Funds Available			Yes <input type="checkbox"/>	No <input type="checkbox"/>	FY _____

Part 5: Higher HQ Decision Path			
Formation HQ		Approved <u>Not</u> Approved Recommended <u>Not</u> Recommended (*Circle selected decision)	
Formation Operating Funds Available?		Yes <input type="checkbox"/>	No <input type="checkbox"/> FY _____
Name _____	Appt _____	Signature _____	Date _____
<u>Formation Comment:</u>			
Command HQ		Approved <u>Not</u> Approved Recommended <u>Not</u> Recommended (*Circle selected decision)	
Command HQ Operating Funds Available?		Yes <input type="checkbox"/>	No <input type="checkbox"/> FY _____
Name _____	Appt _____	Signature _____	Date _____
<u>Comd HQ Comment:</u>			
LC(L) DLEM		Approved <u>Not</u> Approved Recommended <u>Not</u> Recommended (*Circle selected decision)	
DLEM Operating Funds Available?		Yes <input type="checkbox"/>	No <input type="checkbox"/> FY _____
Items in Stock?		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Name _____	Appt _____	Signature _____	Date _____
<u>DLEM Comment:</u>			
NZDF Capability Land Lead		Approved <u>Not</u> Approved Recommended <u>Not</u> Recommended (*Circle selected decision)	
New Equipment?		Yes <input type="checkbox"/>	No <input type="checkbox"/>
PRF Raised?		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Unit / Fmn / DLEM* to fund? (*Circle selected decision)		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Name _____	Appt _____	Signature _____	Date _____
<u>NZDF Capability Land Lead Capability Comment:</u>			
LC(L)			
<u>DLEM Final Comments:</u>			
Fund from	DLEM Op?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Cap Funding?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	PRF Raised (CAPEX only)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
LC(L) Ops Plans			
NZET Manager	NZET Changed	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Name: _____	Appt _____	Signature: _____	Date: _____

Project Risks

The following assessment identifies potential risks that can influence the completion of the project. This assessment is sourced from the ISO 31000 and presents the most influential risks to the project and to what level they pose a threat using a color coded system. A mitigation/s for each threat is then provided. The table below shows how the risks are graded.

Table 1: Risk impact as specified by AS/NZS 4360

		Consequence				
		Insignificant (E)	Minor (D)	Moderate (C)	Major (B)	Catastrophic (A)
Likelihood	Rare (1)	L	L	M	M	H
	Unlikely (2)	L	L	M	M	H
	Possible (3)	L	M	H	H	H
	Likely (4)	M	M	H	H	V
	Almost Certain (5)	M	H	H	V	V

#	Risk Description	Impact	Risk Impact			Mitigation
			Likelihood	Consequence	Risk	
1	Inadequate time to complete project by 18 Feb 14.	Project report will conclude with Stage Six and Seven incomplete.	3	D	Med	<p>Ensure System Design Framework provides detailed specification requirements for implementation at a later date</p> <p>Detailed handover to staff member/custodian for implementation (CAPT Petre).</p> <p>Project will be completed regardless of university timelines.</p>
2	TTS Staff resistant to change.	Current staff do not want to change teaching methodology and CAD suite operates inefficiently.	4	C	High	<p>Run effective train-the trainer courses.</p> <p>Ensure benefits to the apprentices are recognised by all staff.</p> <p>Ensure support from the top is displayed to the lower levels of management.</p> <p>Simple, easy to use system.</p>

3	Cost analysis does not warrant CAD suite.	Stage-gate model stops project before money is spent.	1	B	Med	<p>Ensure most cost effective options are investigated.</p> <p>Alternate projects to finish ENMG 608 identified.</p>
4	Security implications prevent CAD models being utilised from DLE.	Models will not be of military equipment	3	E	Low	<p>More time allocated to download and draft models.</p>
5	High reliance on CIS to install and provide computers	If CIS cannot provide hardware and installation then a delay in setup will occur along with additional costs.	4	C	High	<p>Provide early warning to CIS (Nov 13) of a job request for early Jan.</p> <p>Investigate alternate options for setup.</p>
6	Other projects are delegated from higher authorities to Capt Vollebregt.	Time allocated to CAD project reduced	2	D	Low	<p>Ensure superiors understand importance of project deadlines.</p> <p>Delegate tasks where appropriate.</p>

Table 2: Risk Assessment

Trade Training School



Appendix F
Train-the-Trainer Prog

CAD Introductory Instruction Package

General

Trade Training School Trentham has recently implemented CAD software to enhance the current curriculum and improve the capability and scope of areas which can be taught to attending engineering students. This software can be utilised in programming CNC machines in the manufacture of products, provide a 3D modelling function to give students a visual understanding of how components assemble together. It can therefore create a moveable structure to investigate and provides a means of drawing – in isometric, oblique and first and third angle orthographic – components as part of an assembly.

There will be no formal qualification gained in attending/ completing this training package. This package is designed as a train the trainer familiarisation and is designed to give a basic understanding of navigating and utilising the fundamental aspects of the software.

Two assignments will be issued for completion to enable the instructor to gauge the extent of understanding individuals are gaining throughout the week. At the completion of the course attendees will receive a grading which will allow (or not allow) them to provide future instruction to students based on how well they complete the assignments.

Recommended Equipment

All equipment required will be provided to personnel attending the package. A personal calculator would be beneficial to complete dimensions etc.

ENGINEERING CAD INTRODUCTORY PACKAGE

Ser	Date	Time	Activity	Location	Remarks
1.	Mon 10 Feb 14	0800 – 1000hrs 1000 – 1020hrs 1020 – 1200hrs 1200 – 1300hrs 1300 – 1500hrs 1500 – 1520hrs 1520 – 1630hrs	PT/ Morning Break Introduction Using Online CAD Tutorials Lunch Using Online CAD Tutorials Afternoon Break Using Online CAD Tutorials	Gym Wpns Room	Online
2.	Tue 11 Feb 14	0800 – 1000hrs 1000 – 1200hrs	PT/ Morning Break Sectioning/ Dimensioning Drawings	Gym Wpns Room	

		1200 – 1300hrs 1300 – 1500hrs 1500 – 1520hrs 1520 – 1630hrs	Lunch Drawing basic structures Afternoon Break Drawing basic structures		Individual Practice Cont.
3.	Wed 12 Feb 14	0800 – 1000hrs 1000 – 1020hrs 1020 – 1200hrs 1200 – 1300hrs 1300 – 1500hrs 1500 – 1520hrs 1520 – 1630hrs	Drawing Basic Structures Morning Break Assemblies Lunch Assemblies/ 3D Modelling Afternoon Break Weldments		Cont. Cont.
4.	Thu 13 Feb 14	0800 – 1000hrs 1000 – 1200hrs 1200 – 1300hrs 1300 – 1500hrs 1500 – 1520hrs 1520 – 1630hrs	PT/ Morning Break Creating BOM/ cutting lists, CAD/CAM Concepts, Fits and Limits. Lunch First Assessment Afternoon Break First Assessment		
5.	Fri 14 Feb 14	0800 – 1000hrs 1000 – 1020hrs 1020 – 1200hrs 1200 – 1300hrs 1300 – 1500hrs 1500 – 1520hrs 1520 – 1630hrs	Second Assessment Morning Break Second Assessment Lunch Complete and hand in all assessments. Afternoon Break Discussion/ Forum		

Once assessments have been graded individuals will be notified of their respective grading and whether able to progress to training others. Should the outcome of the assessment highlight a deficiency in the individuals understanding further training can be sought from the tutor IOT bring them up to the required standard.

Summary of Recommendations:
NZ Defence Force - NZ Army

Proposal for

Ref: CPS-9671

Date: Tuesday, 26 November 2013

Qty Unit Rate Total

To:

From:

Benjamin Vollebregt

Eric Stride

Autodesk Product Design Suite Ultimate 2014 20 \$415.00 \$8,300.00

Permanent License

Includes: Autodesk Inventor Professional, Alias Design, AutoCAD Mechanical, Vault, Mudbox, Sketchbook Design, Showcase and 3ds Max Design, Navisworks Manage

Autodesk Product Design Ult Subs - New 20 \$65.00 \$1,300.00

Subscription Program provides 1 Year of:

- Software Upgrades
- WEB Based Support
- Home Use License
- Access to Autodesk Cloud Services

Pricing based on a 1 Year Term

Autodesk Product Design Suite Ultimate 2014 20 \$165.00

Term License

Includes: Autodesk Inventor Professional, Alias Design, AutoCAD Mechanical, Vault, Mudbox, Sketchbook Design, Showcase and 3ds Max Design, Navisworks Manage

Sub Total \$9,600.00

GST \$1,440.00

Total Cost \$11,040.00

Any additional equipment or software not covered in this proposal that requires setup or configuration at the client's request, will be carried out at a rate of \$125 per hour.

Installation and Configuration:

For Educational Lab - Trade Training School

Special Terms and Conditions:

Terms and Conditions:

1. The quoted amounts are subject to GST and Freight.
2. This proposal is valid for a period of fourteen days. Note that this proposal must be read as a whole. If individual items are ordered separately the quoted prices may vary.
3. Exchange Rate fluctuations of the New Zealand dollar by plus or minus 3% against the US or Australian dollars may affect the quoted figures in this proposal.
4. Please note that should a client purchase a training module as part of their order, that training module must be used within 12 months of date of installation of the system, otherwise the client will forfeit the right to that training.
5. If an order is cancelled, a 20% restocking fee of quoted pricing applies. Supplied equipment returned after delivery and/or installation may incur a 50% restocking fee.
6. Note that CADPRO Systems Ltd will retain ownership of all the goods offered, irrespective of whether they are resold by the original purchaser, until final payment is made. If payment is not made accordance with the above conditions CADPRO Systems Ltd reserves the right to enter upon any premises and retrieve the goods.
7. A deposit of 30% is due at time of order with final payment due within 7 days of above supplied equipment and services.
8. If payment is not made in full by the due date, we are entitled to charge you interest on the unpaid overdue balance at the rate of 5% per annum above the current overdraft rate charged by our bankers, compounding monthly on the unpaid balance owing on the first day of each month until payment in full is received by us, and we may charge you costs (including collection costs and legal costs on a solicitor-client basis) and suspend delivery of further Products or performance of further services until the account is paid.
9. Acceptance of this proposal confirms acceptance of these terms.